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ABSTRACT

The problems of instruction in interdisciplinary fields of college curricula are addressed in this guide, which is an outgrowth of a seminar. The observations on interdisciplinary studies apply both to programs of interdisciplinary studies as well as to individual interdisciplinary courses. The problems faced by the practitioner of interdisciplinary studies are also faced by all teachers regardless of field. The developmental process of general teaching methods is applied to the special problems of interdisciplinary studies in this guide. The following areas are addressed: definition of interdisciplinary studies, course and content selection for interdisciplinary studies, production and implementation of interdisciplinary courses and curricula, evaluation of interdisciplinary studies, and common problems with interdisciplinary teaching. (SW)

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Practitioners' Views on . . .

INTERDISCIPLINARY STUDIES

AT THE COLLEGE LEVEL

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INTERDISCIPLINARY STUDIES AT THE COLLEGE LEVEL

Purpose

This guide addresses the problems of instruction in interdisciplinary fields of college curricula, and is an outgrowth of a seminar on instructional development on the subject of "Technology, Values, and Society" sponsored by The Associated Colleges of the St. Lawrence Valley at Syracuse University, January 4-6, 1978.

Representatives of the Associated Colleges (St. Lawrence University, Clarkson College, State University of New York at Potsdam, and State University of New York Agricultural and Technical College at Canton) met during the three-day seminar with representatives of the Center for Instructional Development (CID) at Syracuse University to discuss their experiences and views on interdisciplinary instruction. The workshops held during this time brought together faculty who teach classes ranging in size from ten to several hundred students, whose backgrounds and academic specializations are diverse, but who, despite this diversity, are committed to interdisciplinary studies in the college curriculum. The data for this report come from those workshops, and we have reduced it here to a guide because of the striking coherence of views and uniformity of personal experiences expressed by the participants.

The observations on interdisciplinary studies here apply both to programs of interdisciplinary studies as well as to individual interdisciplinary courses. In general, we found that the problems faced by the practitioner of interdisciplinary studies are also faced by all teachers regardless of field. What we have done here, in part, is to apply the developmental process of general teaching methods to the special problems of interdisciplinary studies.

Procedure

The Center for Instructional Development gave presentations and guided workshops on such topics as the process of academic change, the identification of student needs and interests, and the setting of instructional objectives. The subject, "Technology, Values and Society", was selected because its breadth was felt to be sufficient to raise most of the issues of interdisciplinary studies. Participating faculty (see listing below*) were selected from the member institutions of the Associated Colleges consortium. Following presentations on each of the various topics, these teachers met in work sessions to exchange ideas and observations on how the issues affected their individual professional practices.

The proceedings of the workshops were audio-taped, and transcripts were prepared from these recordings. These data were then sifted, sorted, and organized to produce this guide.

Special thanks are due the teachers who participated in the seminar workshops; to CID for assistance with the audio-tapings; to Fritz Grupe, Executive Director of the Associated Colleges consortium, for his supportive efforts; to George Gibson, Vice-President and Dean of the College, St. Lawrence University, for his encouragement of this research; to John Yearwood, of Canton, who rewrote and edited parts of this report; and to the Kellogg Foundation, whose generosity provided funds for the seminar.

The issues which were raised at the seminar, and around which this guide is organized, are:

1. Definition of interdisciplinary studies,
2. Course and content selection for interdisciplinary studies,
3. Production and implementation of interdisciplinary courses and curricula,
4. Evaluation of interdisciplinary studies,
5. Common problems with interdisciplinary teaching.

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*The following participants met to offer their insights and recommendations:

St. Lawrence University

John Fendrich, Mathematics
George Frear, Religious Studies
John McGovern, Psychology
Jeff Stewart, Religious Studies

SUNY Potsdam

Martin Bertman, Philosophy
Fred Brouwer, Philosophy
Bruce Campbell, Chemistry
William Chmurny, Anthropology
Dick Merchant, Speech & Hearing
Austin Spencer, Economics
William Thompson, Philosophy

Clarkson College

Marvin Edwards, Social Sciences
Walter Grattidge, Ed. Resources
Don Rosenthal, Chemistry
Paul Sammarco, Biology
Dennis Welch, Humanities
Kenneth Willmert, Engineering

SUNY A.T.C.

Steven Crane, Social Sciences
Patricia Roach, Social Sciences
Mary Simpson, Social Sciences
Donald Washburn, Social Sciences
John McKean, Dean, Arts & Sciences

Campus Coordinators: William Fox, St. Lawrence University; A. George Davis, Clarkson College; Bruce Conroe, SUNY Potsday; John Pope, SUNY Agricultural and Technical College at Canton.

Definitions

Interdisciplinary study is an integrated approach to instruction with learning holistic knowledge as its major purpose. The "model" for an interdisciplinary studies program has been around for centuries - it's called the Bachelor of Arts degree. This is "interdisciplinary studies" in its broadest sense, and this sense is too broad to be of much use to us. As the term has evolved in more recent years, "interdisciplinary studies" has come to mean those courses and programs within the curricula for the traditional Bachelor of Arts or Sciences degrees which focus on and are designed to facilitate the kind of holistic knowledge that has been the goal of liberal arts education all along. In general, these interdisciplinary studies courses and programs have attempted to integrate learning according to two concepts: the Multifield concept and the Cross-Discipline concept.

The multifield concept assumes that fields of study, when placed in sufficient proximity, will cross-pollinate. By what wind or bee is not necessarily the major concern of the instructor, whose belief in the human mind's inexorable tendency towards holism precludes any doubts he or she may have about the fertility of those minds receiving the instruction. The focus of multifield courses and programs is on the content of the various fields combined in the study and, in part, on the traditional or recognized boundaries of those fields. For example, a course titled "Studies in Human Time" might combine history, English, and psychology as fields of study occupying distinct segments of the syllabus with no attempt on the instructor's part to bridge the gaps between each field's approach to the subject. The history segment might explore methods of determining past fact and degrees of cause; the English segment might study the novel as a genre dealing with change; the psychology segment might explore the development of a sense of self. Multifield courses maintain the differences between fields but combine their methods. This concept was preferred by the majority of seminar participants, though with some modification from this extreme view.

The cross-discipline concept assumes that there are fundamental similarities in the methods of different fields of study, and courses following this concept focus their attention on these theoretical underpinnings. Multifield courses focus on the content of the fields; cross-discipline courses focus on the methods of the fields. For example, a cross-discipline course called "Concepts of Human Time" might combine history, English, and psychology (as in the previous example), addressing various items for discussion from each field's point of view during every class period. Thus, Shelley's "Alastor" might be discussed on one day from an historical perspective (the life of John Keats and his importance), from a literary perspective (the poetics of the elegiac mode and its varying senses of time), and from a psychological perspective (what do we know about Shelley that might explain his motive in writing an elegy on John Keats). The purpose of the discussion would be to arrive at an understanding of principles for the selection of data in each field, and then an understanding of the methods followed in each field's analysis of data. Cross-discipline courses emphasize the transferability of skills between fields, and their ultimate purpose is to provide students with a battery of

problem-solving techniques that will work equally well in many fields of study. The disadvantage of cross-discipline courses, in the eyes of the seminar participants, is that they blur the traditional distinctions between fields, distinctions that have been laboriously arrived at only with much controversy and over extended periods of time.

In actual practice, almost all interdisciplinary courses and programs use both multifield and cross-discipline approaches together. It would seem impossible, in fact, to teach always according to one of these concepts and never according to the other. Thus, in what follows, we have not thought it necessary to distinguish between these two species of interdisciplinary courses. Nor have we distinguished between "courses" and "programs", since the principles of combination and integration apply to the parts no less than to the whole.

The consensus among practitioners and students alike is that when interdisciplinary courses violate traditional field boundaries, conventional thinking about the "proper" or "normal" sequence of teaching and learning is disrupted. As a result, interdisciplinary teaching rouses the sleeping dogs of policy and procedures for faculty to re-examine. Some of the more common issues raised are remediation vs. advanced studies vs. independent research and writing, interdisciplinary studies vs. liberal studies vs. skills development, and interdepartmental vs. intradepartmental offerings. In this context, we propose that the following objectives are necessary to all successful interdisciplinary teaching:

A. Content (i.e., subject matter) and skills (cognitive, affective and, where applicable, psychomotor) should be treated as one and the same thing, and the levels of difficulty in achieving them must be carefully coordinated.

   1. Educational objectives should be explicit and should reflect accurately the interests of departmental boundaries.

   2. Curricular topics and course units should evolve out of the objectives and should reflect accurately and authentically the interests of the academic departments from which they have evolved.

   3. Classwork and assignments should be integrated, i.e., clear and explicit reference should be repeatedly made to what units have in common and to how that shared concern is both meaningful and useful.

   4. The material or skill taught in each curricular or course unit should be generally acceptable to the authorities in the discipline and not be overly reflective of the teacher's personal perceptions.

B. The aims of interdisciplinary teaching should be above all practical and should serve both the interests of students and the respective needs of the disciplines. In order to minimize potential conflicts of interest between students and faculty, every effort should be made to give individual attention to students so that every class and each class member of every class has the opportunity to achieve course and curricular objectives at a homogeneous level.

1. The students are primarily "consumer-oriented" in that they have usually selected interdisciplinary studies to serve specific personal needs. The teacher should cater to those needs insofar as it is possible without infringing upon the rights of other students to achieve their own curricular objectives equally well.

2. Intermediate (i.e., unit) objectives should be realistic. For example, students will vary in their rates of learning.

3. The number of offerings should be sufficiently large to satisfy the greatest number of individual student interests. At the same time, to keep students from getting "lost", counseling, guidance and advisement should be readily available to all students and, where feasible, centralized and professionally staffed.

4. Along with the offerings proper, the personal/professional characteristics of all instructors should be considered, e.g., the individual's interests, teaching styles, and compatability. To most effectively promote these characteristics, instructors should have every opportunity to consult and work with a staff of trained developers.

The above objectives were gathered from views expressed by the faculty participants from the Associated Colleges consortium. Several broadly-stated observations were also made about the nature of interdisciplinary studies.

A. Interdisciplinary studies are concerned primarily with the qualitative factors of content and of fusing those qualities across disciplines, rather than the inclusion of major quantities of individual disciplinary content.

B. Above all, interdisciplinary courses need to raise the kinds of questions which deal with the goals one will find worthwhile throughout one's life. These are questions the teacher can raise honestly and authentically, without pretending to have all the answers and without undermining student participation.

C. Interdisciplinary studies help to counter the tendency toward a loss of human interaction, which often accompanies the conventional, skills-oriented curriculum. Discussions, question and answer sessions, and informal as well as systematic argumantation, emphasize the importance of the listener in communication, whether that person is the instructor or the student or both.

D. Given the present state of the art of interdisciplinary teaching, even the most organized and systematically presented curricula and courses need to use an individualized, interpersonal approach to learning. There should be a strong maieutic -- i.e., Socratic -- flavor to this kind of educational experience.

E. When initiating a program of interdisciplinary studies, participants have to begin at point zero. They have to work together realizing the complications of interpersonal relationships, toward that freedom from traditional discipline-fostered boundaries on knowledge which marks true understanding.

F. Everyone involved has to realize that interdisciplinary teaching takes a well-developed sense of humor because of the complications of interpersonal relationships and the insecurity of sharing disciplinary orientations. Interdisciplinary learning teaches people how to appreciate the seriousness of our situation in life without losing sight of human potential.

G. Because disciplinary viewpoints are shared and at times questioned, departments that are committed to inter-disciplinary studies have to learn to see their educational mission from the point of view of the students. They have to really become service-oriented. This shift in perspective from the traditional posture of simply passing on, or handing down, something called "knowledge" means several things:

1. Changes in the ways manpower is used;

2. Changing the ways courses look to the registrar;

3. Redefining some of the standards in Arts and Sciences (or whatever one calls the departments that handle general distribution requirements); and

4. Expanding the course offerings, and the requirements, in basic communications skills (e.g., basic English composition -- especially vocabulary and grammar; technical writing) which foster both lucidity and

objectivity; even debate and oral interpretation, which inculcate a good sense for the living nature of language and mind.

H. Since students and faculty are often required to synthesize content across traditional disciplinary boundaries, interdisciplinary teaching focuses on the kinds of situations where students must master previous materials before going on to something else. This means that instructors have to keep their expectations in line with different rates of learning, and thus individualize their teaching much more than is required by the conventional approach.

I. In some cases, for either interdisciplinary courses or for programs of interdisciplinary studies, it will be a good idea to make interdisciplinary faculty appointments, that is, faculty who are free of specific department ties. These teachers can act on the professional level almost like "consumer ombudsmen". But faculty who are free of single department ties could find professional politics a problem, particularly regarding advancement. So it will be important that these appointments be of a high level (endowed if possible), and that they be of the caliber and standing of what we sometimes call "university scholars". It is a good bet that many such faculty could be recruited from among distinguished professors who have been forced into retirement.

J. Interdisciplinary studies serve to help students get the lay of the land in terms of educational and vocational opportunities. They can get a good feeling for a wide variety of disciplines in a relatively short time, so their decisions about majors and specializations can be made more efficiently. Many students today will pursue a course of study for this reason alone. Good counseling, guidance and advisement are essential in this respect, which suggests that interdisciplinary teaching can have a very significant role to play in diagnosing the individual student's needs, both from the point of view of short-term remediation and of longer term life-planning.

K. Interdisciplinary teaching has the advantage of providing flexibility or adaptation to various interests. Those interests may be represented by individual faculty, departments, students and administrators alike. This engenders development and renewal interests throughout the institution. It also lends what might be called "practical value" to liberal arts and the humanities while humanizing the public image of the sciences and applied technologies.

L. Interdisciplinary studies, either through program development or through course adaptation, allows colleges a reasonably easy way of adjusting to a variety of pressures. Institutions of higher education feel the pressure from a variety of sources ranging from the strong affective emphasis on today's secondary schools to the problems of the job market. If higher education is to reflect the changes in the fabric of American society and the findings of research which cross conventional disciplinary boundaries (e.g., biochemistry), strong support must be given to research, development and delivery systems in interdisciplinary teaching.

Course and Content Selection for Interdisciplinary Studies

Once the purposes and expectations of interdisciplinary studies have been made clear, the practitioner faces the problems of course and content selection. At this stage, one must come to terms with the sometimes confounding disparity between one's ideal of the best instructional world and what is feasible within one's institution. For example, the interdisciplinary teacher is likely to discover fewer developed materials for interdisciplinary courses than for conventional courses, or that it is difficult to develop a set of requirements (i.e., intermediate objectives and achievement criteria) which can succeed in respecting disciplinary boundaries while assuring a wholesome and holistic educational experience. Previously well-developed and well-received courses from differing fields may become weakened or diluted when they are fused to form courses of interdisciplinary studies. Moreover, the practitioner may feel out of his depth when called upon to teach courses outside his area of academic specialization, and he may find himself working with colleagues who are in the same deep water, all trying to devise means of ascertaining, maintaining and renewing their qualifications and interest levels. Finally, the disruption in discipline boundaries which is axiomatic to interdisciplinary studies must not be allowed to create dissonance in the classroom. Such dissonance can easily result, at this point, in the development process if student needs, and teacher expectations of student achievement, are not carefully examined by the practitioner who is trying to determine content for the course or program.

The seminar participants shared the following views on course and content selection for interdisciplinary studies:

A. Part of the problem, particularly in interdisciplinary programs, is that teachers do not all use the same teaching approaches, even within a single field or department. One person will use a lot of visual aids; another may emphasize a pictorial approach (cognitive and affective mapping, for instance) but spend most of the classtime in lecture. Some may place most of the weight on composition and recitation; others on seminar-style presentation and discussion. Practitioners should consider

ways of pulling these diverse methods together so that they will complement one another in the student's experience. It might help, for example, to write a common syllabus that incorporates just the different textbooks which are in use. Another approach would be to encourage teams of instructors who feel they have compatible instructional styles, philosophies and interests to volunteer to teach in the program.

B. Differences among faculty in attitudes and aptitudes can be handled by requiring everyone to teach and learn in either a comprehensive introductory unit or a core curriculum that is coordinated with workshops and discussion sections.

C. One successful way of encouraging the self-motivation and self-discipline required of both teachers and students is to get them to participate together in planning the objectives and criteria of the course or program. Involvement at this level nearly always leads to a commitment to the learning process.

D. Teachers should be careful not to overwrite their objectives, to overspecify their criteria for achievement, or to make their selections of course offerings too narrow. One of the most exciting aspects of interdisciplinary teaching is the "unintended learning" that occurs. This kind of learning builds up the self-esteem of everyone and fosters genuine creativity. Divergence from the norm of conventional classroom behavior needs to be one of the standards of learning here because there are, in fact, few clear notions about interdisciplinary conduct.

E. The prestige of interdisciplinary courses, and the instructors' faith in their value, must not be allowed to wane as the courses become more and more familiar and less glamourous. One of the worst things that can happen is for the practitioner to feel as if he or she has been "relegated" to interdisciplinary studies. This is a crucial concern, for instructors may become increasingly frustrated if their responsibilities are dictated from above by fiat, or if their assignments seem to derive from the caprice of the academic "marketplace". Two ways to minimize such frustrations are (1) for program chairpersons to be actively engaged in actual teaching, and (2) for chairpersons to effectively delegate administrative and development tasks.

F. Achieving strong departmental support for interdisciplinary teaching is essential, not just fiscally but also in terms of actual manpower. Otherwise, the practitioner can come to feel like a pariah. It is impossible to make the best decisions about course and content selection in a vacuum or if the teacher views an interdisciplinary assignment as a penalty. Likewise, teachers must be assured that their efforts do not detract from their possibilities for advancement. Because of the extraordinary effort involved, in fact, interdisciplinary experience should be considered an asset when it comes to professional evaluation.

G. When it comes to content, teachers should be advised to include sufficient "skills" emphasis. Otherwise, the students and their parents are not likely to see the applications of interdisciplinary work to "real life". Including "skills" in this way has the immediate advantage of eliminating a great deal of uncertainty about materials and terminologies. In some cases, this approach may mean requiring certain technical backgrounds of the students. For example, engineering students who have had sufficient exposure to the field of engineering are more likely to perfect their writing skills if the issues they are assigned as subjects for composition -- such as values clarification -- are derived from the engineering field.

H. Problems with student heterogeneity can be resolved in large part by making sure that faculty have easy access to information on background and past achievement. However, practitioners need to be constantly reminded of the need for impartiality in evaluation. It simply will not do, particularly in interdisciplinary teaching, to label students as being of the "A-type", "B-type", etc., or as "disadvantaged". We are all disadvantaged to some extent in a truly interdisciplinary course or curriculum.*

I. During course and content selection in particular, faculty access to professional developers -- to persons whose job it is to jar their preconceptions about what is possible and appropriate in interdisciplinary studies -- is especially desirable. Such professionals can also help in researching the "marketability" of various options in course and content. This "marketability" is very important during times of academic retrenchment. Although professional developers are not readily available in some locales, an increasing number of institutions are finding reasonable ways of providing this service. Consultation for a fee, faculty exchanges, and developing internal resources and personnel are examples of ways to overcome the scarcity of professional developers.

*For further suggestions about dealing with student heterogeneity, see Stephen C. Brock, Practitioners' Views on Teaching the Large Introductory Course, pp. 4-7.

Production and Implementation of Interdisciplinary Courses

After course and content selection has been made, the practitioner becomes involved in the "dirty work" of specifying the working details of his or her project and in implementing the course in a student population.

The following suggestions are offered by some faculty from the Associated Colleges consortium. We should point out that not all of these considerations are unique to interdisciplinary studies.

A. Arbitrary formats will not do for interdisciplinary studies any more than they will for conventional courses. In interdisciplinary courses, the format should be dictated by the content/skills. The practitioner should not decide, for example, to deal with everything from the point of view of programmed instruction and then try to force concerns that do not fit such a format.

B. The practitioner's classroom methods should vary according to the demands of content or student need to exercise personal judgement.

C. Review of the entire production and implementation process should be carried out in some detail from the perspectives of availability and allocations, resources and rewards, anticipated support, and conflict of interests. The savings in energy and time achieved by this kind of fine honing and coordination of the curriculum will allow for the inclusion of more options and individualization of instruction than might otherwise be possible.

D. The teacher should remember that each discipline in the interdisciplinary course will demand an equal amount of attention from the student. Thus, the allotment of time is very important: information-giving during class should be restricted to segments that are just long enough to allow coverage of the most critical incidents or examples in any given field. One way to insure that you are not attempting to cover too much ground is to use an index card to list the critical incidents or examples. If you start to overload the card, you can be sure that you are trying to put across too much information in the time allowed.

E. Avoid the tendency to rely on personal preferences because this undermines the interdisciplinary nature of the course or program. Consult with colleagues and students about the critical learning paths you hope to follow. This is as important to the Production and Implementation stage as it is to the Content and Course Selection stage. Remember as well that the printer of your manuals will have a lot to say about both the shape of your materials and their availability.

F. The practitioner should talk with the registrar about the way the course or curriculum is to be listed or crosslisted, about the possibilities for variable credit so that students who want to do more than the minimum do not find themselves with the problems of unrewarded overachievement.

G. When the teacher wants to implement flexible registration or continuous registration approaches, as well as variable credit plans, it is most important to set the achievement criteria in some detail so that tracking of student performance is as accurate as possible. In such systems, where students have the greatest incentive and freedom of choice, the students should be continually reminded of their options and opportunities as well as of various deadlines for their work. Some students could, for example, finish all their work in one term and easily forget to register for the second term or not take advantage of the new "free time" which is theirs. Some of this "free time" could not only be devoted to independent study but also to remediation or actual improvement of recorded achievement levels.

H. With regard to F. and G., it is not always possible to jump right into new scheduling and accreditation schemes no matter how useful and powerful they may be as instructional tools. The interdisciplinary teacher must always have an eye open for loopholes that already exist within the present system into which he could put some new ideas for trial study. There are loopholes in any system, and one should not hesitate in finding them out and taking advantage of their potential for improving the system.

I. Sometimes it is felt that there is not enough manpower to handle all the contents and skills which make up an interdisciplinary format. Changing the format often remedies the situation. Remember that administrative approval is generally not needed to change formats as long as students or faculty are not overloaded by the change.

J. Because interdisciplinary courses disrupt conventional boundaries, they can cause confusion for the student. To avoid this confusion (or rather, to turn it into a positive force), the teachers should know exactly what they want from the students and should be careful to explain their expectations to the students. Definite and specific guidelines for options will tell the teacher very rapidly just what is and is not a practical expectation. Writing one-page descriptions of what the teacher expects students to be like will also be helpful in determining production and implementation. But most importantly, the practitioner should explain everything in writing and, as often as necessary, verbally, Do not add to the confusion inherent in interdisciplinary studies by being vague.

K. Do not let an interdisciplinary course become "owned" by any single instructor or field. Otherwise, the course will lose its flexibility and gradually cease to be interdisciplinary. Step-by-step planning of discrete sections of the interdisciplinary course might be the best way to simplify the process of implementation and clarify the instructors' expectations. This is particularly reasonable when faculty from various departments are involved in the planning and teaching, for they may not be familiar with one another.

Evaluation of Interdisciplinary Studies

While only mentioned explicitly here, evaluation of interdisciplinary studies should be a continual, ongoing, and instructive process. It happens at every stage along the way. Without ongoing evaluation, instructors, students and administrators alike can quickly lose the sense of an integrated approach. When this occurs, the course or curriculum becomes just another part of the academic "game", thus ceasing to function in a truly interdisciplinary fashion. On the other hand, evaluation activities must be carried out in a low-key manner, and steps must be taken to protect everyone involved with the project from the tyranny of tests.

The following views were shared by the faculty participants of the Associated Colleges consortium. They may not be shared by others with experience in teaching interdisciplinary courses or in interdisciplinary programs.

A. "Goal-free" evaluations of the course are necessary to maintain the balance between intended and unintended learning outcomes. To conduct a "goal-free" evaluation, the practitioner should invite several faculty and students who do not work in the interdisciplinary course to simply move in unannounced to observe and try to gather as much information as they can by sitting through several classes. These guests should then describe their experiences without making reference to any of the stated learning goals. Collation of these descriptions constitutes a "goal-free" evaluation.

B. A premise of any evaluation of interdisciplinary studies must be that they are fundamentally experimental and, thus, subject to change. Because of this, summative evaluations should be rare. Rather, most evaluations should be formative in nature, i.e., looked upon as devices to improve the quality of instruction.

C. As with any program, there will be complaints. Complaints should not be prematurely brought against interdisdiplinary studies programs or courses until they have had sufficient time to achieve viability. The group felt that it is

reasonable to allow four or five years for the interdisciplinary studies program to establish itself. During this period, practitioners should have the greatest possible flexibility in changing guidelines and formats -- every semester, if necessary -- to arrive at the best possible mesh of teaching conditions and personnel characteristics. Meanwhile, practitioners should be warned once again about maintaining the breadth of the interdisciplinary course. Evaluation input should be as broad as possible so that courses or curricula do not end up reflecting only a single bias. Since interdisciplinary courses, by definition, include the content of one or more disciplinary areas, expectations may be high for student achievement in content areas. Also, normally students are expected to synthesize concepts from a variety of subject areas. Therefore, in interdisciplinary courses and curricula, students and teachers alike need more time for learning than for taking exams.

D. It takes time to produce and fully implement interdisciplinary courses, and this is sometimes frustrating to the practitioner who wants to get on with it. Impatience is a real hazard here. Skimping on any one step might bias the entire course design. The tendency to premature conclusions is strongest, perhaps, when one is working with colleagues one has worked with before.

   Simulations are important to effective design of materials, and impatience should not be allowed to influence practitioners to omit these. Simulations take time and money, but not as much as some people think. Many designs can be tried out in vitro for little more than the cost of a single course.

E. Once students have been motivated to independent learning in a multifield situation, it is all too easy to leave the "connective thinking", the cross-discipline aspect, to them. Interdisciplinary teachers must always be trying to draw out these connections -- it is essential to their own professional renewal that this be done.

Final Caution

After working some time in interdisciplinary situations, many teachers begin to feel that they have not solved the problem of an integrated approach, but have just confirmed that there is one. Should this occur, it is crucial that the practitioner not take this situation too personally -- it is, after all, the perennial anguish of teachers committed to continually improved learning.